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enlarges and forms the zygote or zygospor. The zygospor becomes surrounded by a thick wall showing differentiation into several layers. In its completed state it is inclosed in a network of hyphae whose walls fuse and become greatly thickened, forming, in cross-section, a sort of a corona around the zygospor. The nuclei were not observed to fuse in the zygospor of this species, but in *Endogone Ludwigii* a single large nucleus, supposed to be a fusion nucleus, was observed in some of the zygospor. This process of zygospor formation was observed only in the two species mentioned. In the other species the fruit body is filled with asexually formed chlamydospores or with sporangia in place of zygospor.

In his discussion the author points out the close resemblance between the sexual reproduction of *Endogone* and the mucors on the one hand, and on the other hand certain homologies between *Endogone* and the Ascomycetes. Thus in the peculiar outgrowth of the fusion cell and the paired nuclei, he sees a homologue of the ascogenous hyphae of the Ascomycetes, in some of which (as CLAUSSEN has shown for *Pyronema confluens*) the male and female nuclei do not fuse, but remain in pairs until the formation of the ascus.—H. HASSELBRING.

Position of Gnetales.—In 1911 LIGNIER and TISON published a brief statement of their view that Gnetales are apetalous angiosperms, a statement that was noted and commented upon in this journal.¹³ Now they have begun the publication of an extended argument for their position, the first part dealing with *Welwitschia*.¹⁴ A very full résumé of the literature prepares the way for a consideration of all the kinds of testimony available. The conclusions reached cannot be attacked on the basis of insufficient knowledge of the facts at hand, but of course they rest upon personal judgment as to the relative importance of the testimony, as do all conclusions in reference to phylogeny.

The general contention in reference to *Welwitschia* is that the two kinds of strobili ("inflorescences") have identical organization; that in the axil of each bract there occurs a flower of the angiosperm type, comprising five cycles of members; that the two innermost cycles form a tetracarpellary closed ovary prolonged into a long style; that the functionally monosporangiate flowers are obviously derived from more primitive bisporangiate flowers; that *Welwitschia* has retained a large number of gymnosperm characters, especially in its "anatomy and histology"; that in evolution such recondite characters change least rapidly, and therefore the phylogenetic position is to be determined by the floral characters, which are essentially angiospermous; that the great reduction of flowers and their aggregation into inflorescences do not suggest angiosperms in general, but rather a very specialized lateral phylum; that the method of specialization resembles that of the *Amentales*, and therefore *Wel-*

¹³ BOT. GAZ. 51:479. 1911.

¹⁴ LIGNIER, O., et TISON, A., Les Gnétales, leurs fleurs et leur position systématique. . Ann. Sci. Nat. Bot. IX. 16:55-185. figs. 40. 1912.

witschia and *Amentales* belong to the same lateral phylum, the former at its base, the latter at its summit; that by comparing *Welwitschia* on the one hand with gymnosperms and on the other with angiosperms one may obtain a rough reconstruction of the characters of proangiosperms.

The crux of this whole argument is the interpretation given to the inner, micropyle-forming integument as of carpellary nature. If this is true, no other testimony is needed; and if it is not true, then no other testimony can show the angiosperm level. As stated in the former notice, this contention in the main brings us back to the old conflict over gymnospermy. It is clear that *Welwitschia* is a member of a reduction series, and one can imagine an open ovary derived from a closed one, for there are open ovaries among angiosperms; but it is not easy to imagine a reversion to such structures as archegonia, etc., unless proangiosperms may have retained archegonia in stages of elimination.

It will be interesting to note the disposition made of *Gnetum* and especially of *Ephedra* in the subsequent papers.—J. M. C.

Investigations on Coprinus.—WEIR¹⁵ reports a series of miscellaneous investigations on various species of *Coprinus*. He finds that the deliquescence of these forms is brought about by the action of digestive enzymes and goes on entirely without the aid of bacteria. The digestive enzymes are most abundant when the fruit bodies approach maturity. The various parts of the fungus show considerable differences in resistance to the action of these enzymes. None of the young tissues are affected by extracts of older individuals. Parts of the gills and pileus of older plants, however, are readily dissolved, while the stems are not much affected. Other enzymes whose presence was shown by appropriate methods are tyrosinase, peroxidase, catalase, emulsin, amidase, diastase, coagulase, invertase, cytase, pectase, lipase, and rennetase.

The rest of the paper deals mostly with questions of experimental morphology, and more particularly with the relation between the capacity for regeneration of these fungi first pointed out by BREFELD, and the degree of differentiation of the regenerating tissues. It is found that in the very young fruit body the power of regeneration is not localized, but that all parts are capable of producing new plants from all cut surfaces. In the young cut stem, pilei grow out most readily from the pith, but later, when the pith has disappeared, the regenerating zone moves outward toward the periphery. In the pileus, regeneration takes place most readily at first in the region which is to become the hymenium, and later in the trama. The cuticle is not capable of regeneration. Plants whose pilei were imbedded in plaster or stems whose upper parts were thus imbedded, after removal of the pilei, produced new outgrowths along the lower part of the stems. Attempts at grafting parts of fungi on other individuals of the same species succeeded easily and gave

¹⁵ WEIR, JAMES R., Untersuchungen über die Gattung *Coprinus*. Flora 103: 263-320. figs. 25. 1911.